Contribution ID: **36** Type: **not specified**

Bistable Boron related defect associated with the acceptor removal process in irradiated p-type silicon –electronic properties of configurational transformations

Tuesday 20 June 2023 10:00 (20 minutes)

According to the observed "Acceptor Removal"effect a radiation induced Boron Containing Donor (BCD) defect is formed in p-type silicon. This defect shows bistable properties that are observed in variations of the depletion voltage as determined from C-V/I-V characteristics in PAD and LGAD structures irradiated with 10ˆ14 1 MeV neutrons/cm2. The electronic properties of the BCD defect in its two different configurations (A and B) are presented alongside with the transformation kinetics in the 243 K- 308 K temperature range. We show that in the presence of carriers in excess, a transformation of defect structural configuration from A to B takes place. The reverse configurational transformation appears when the excess carriers are removed. Energy barriers of 0.36 eV and 0.94 eV are determined for the A⟶B and B⟶A configurational transformations of BCD defect, respectively. The determined transformation rates indicate that the defect structural transformations are accompanied by electron capture for the A⟶B conversion and by electron emission for the B⟶A transformation. A configuration coordinate diagram of the BCD defect transformations is proposed.

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Session Classification: Defects